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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/898,043	07/05/2001	Nobuhiko Hayashi	010849	2566

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EXAMINER

MONDT, JOHANNES P

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 10/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/898,043

Applicant(s)

HAYASHI ET AL.

Examiner

Johannes P Mondt

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 July 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 25-28 and 30-37 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 25,27,28 and 30-37 is/are rejected.
- 7) ☒ Claim(s) 26 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendment filed July 28, 2004 forms the basis of this official action. In said Amendment Applicant substantially amended all pending claims 25-28 and 29-37 through substantial amendment of independent claim 25. Comments on Remarks in said Amendment are included below under "Response to Arguments".

Response to Arguments

1. Applicant's arguments filed July 28, 2004 have been fully considered but are not persuasive. The present rejections are based on Nagahama et al (6,172,382) because of the following considerations: Nagahama teach the p-side cladding layer to have a flat portion on both sides of the ridge portion 318 (see Figure 9, col. 36, l. 61-63 and col. 66, l. 4-8, i.e., claim 7 in Nagahama et al) with a thickness between 0.02 μm and 1 μm (see Nagahama et al, loc.cit.). The range of Nagahama et al is thus seen to overlap the claimed one. Nagahama et al evidently realize said range more preferably is to be limited to between 0.05 μm and 1 μm (see col. 23, l. 3-10). The rejections of claims 25, 27-34 and 36-37 and of claim 35 (only traversed through claim 25) are based on the above considerations. However, traverse of the rejection of claim 26 is accepted (see "Allowable Subject Matter").

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. **Claims 25, 27-34 and 36-37** are rejected under 35 U.S.C. 102(e) as being anticipated by Nagahama et al (6,172,382 B1).

Nagahama et al teach a nitride based semiconductor laser device comprising (cf. fourth embodiment, Figure 9):

a light emitting layer 314/315/316/317 (cf. col. 36, l. 10-16, l. 18-28, l. 30-38 and l. 40-46), composed of a Group III nitride based semiconductor (InGaN) (cf. col. 36, l. 18 – 28) and including an active layer 315 (loc. cit.); and

a cladding layer 318 (cf. col. 36, l. 47-52) of a first conduction type (p-type) composed of a Group III nitride based semiconductor (cf. col. 36, l. 47-53), formed on said light emitting layer, having a larger band gap (cf. col. 12, l. 53-59 and col. 36, l. 47-52: note that the comment in column 12 on a higher band gap for the p-type cladding layer when the latter functions as carrier trapping layer also applies to the fourth embodiment as evident from the cited portion of column 36 on the material constitution of said p-type cladding layer) and lower refractive index (cf. col. 38, l. 10-38), said cladding layer of a first conduction type having a ridge portion (cf. col. 34, l. 40-45 and Figure 9), and the maximum thickness (i.e., maximized over location) of said cladding layer of a first conduction type being less than 0.3 μm , because the range for the thickness of said cladding layer of the first conduction type 318 is 50 Å - 1 μm (cf. col.

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40, l. 15-31) and hence is seen to substantially overlap with the claimed range of 0 – 0.3 μm , and said flat portion having a thickness inherently less than the thickness of the p-type cladding layer as a whole, which Nagahama et al claim as between 0.02 μm and 1 μm (see claim 7 in Nagahama et al, col. 66, l. 3-8) and which Nagahama et al further describe as being more preferably between 0.05 μm and 1 μm (cf. col. 23, l. 3-10).

In conclusion, Nagahama et al anticipate claim 25.

On claim 27: Nagahama et al teach that said light-emitting layer further includes an optical guide layer 317 (cf. col. 36, l. 40-45) and that said optical guide layer may be a GaN layer (cf. col. 36, l. 40-45). In view of the constitutions of the materials of the active layer (InGa_N), optical guide layer (GaN) and the p-cladding layer (AlGa_N) and the ordering of the dielectric constants, $2.15 \approx \epsilon_{\text{AlN}} < \epsilon_{\text{GaN}} \approx 2.6 < \epsilon_{\text{InN}} \approx 2.9$ (cf. for instance Rumyantsev et al, "Properties of Advanced Semiconductor Materials: GaN, AlN, InN, BN, SiC, SiGe", M. Levinshteyn et al, particularly, pp. 16 (GaN), 39 (AlN) and 58 (InN)) and the near-linearity for small values of the stoichiometric parameter the refractive index (= square root of said dielectric constant) of said optical guide layer is higher than that of the cladding layer and lower than that of the active layer. Furthermore, in view of the expressions $E(\text{Al}_x\text{Ga}_{1-x}\text{N}) = x \cdot E(\text{AlN}) + (1-x) \cdot E(\text{GaN}) + b \cdot x \cdot (1-x)$ and $E(\text{In}_x\text{Ga}_{1-x}\text{N}) = x \cdot E(\text{InN}) + (1-x) \cdot E(\text{GaN}) + b \cdot x \cdot (1-x)$ and the values $E(\text{InN}) = 1.95 \text{ eV}$, $E(\text{GaN}) = 3.40 \text{ eV}$ and $E(\text{AlN}) = 6.20 \text{ eV}$ (cf. S. Nakamura et al, "The Blue Laser Diode", Springer Verlag (Berlin, Heidelberg, New York), Second and Enlarged Edition (2000), ISBN: 3-540-66505-6, pp. 161-162 and: "Introduction to Nitride Semiconductor Blue Laser Diodes and Light Emitting Diodes", Editor: S. Nakamura; Taylor and Francis (New York), p. 357

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(2000)) said optical guide layer of first conduction type has a smaller band gap than said cladding layer of first conduction type and a higher band gap than said active layer. Finally, said cladding layer of first conduction type is formed on said optical guide layer of first conduction type.

On claim 28: Nagahama et al further teach that said light-emitting layer further includes a carrier leakage prevention layer 316 (cf. col. 36, l. 30-38) of first conduction type (p-type) formed on said active layer (cf. Figure 9) and having a larger band gap than said optical guide layer of first conduction type (cf. col. 36, l. 40-41); and said optical guide layer of first conduction type is formed on said carrier leakage prevention layer of first conduction type (cf. Figure 9).

On claim 29: the thickness of said ridge portion in Nagahama et al is less than 0.3 μm (cf. discussion of claim 25, which claim 29 fails to further limit: see claim objection above).

On claim 30: in Nagahama et al said Group III nitride based semiconductor contains gallium, aluminum and indium (cf. col. 35, l. 20 – col. 37, l. 35).

On claim 31: in Nagahama et al said cladding layer 318 of first conduction type contains gallium and aluminum (cf. col. 36, l. 47-52).

On claim 32: in Nagahama et al said active layer 315 contains gallium and indium (cf. col. 36, l. 18-28).

On claim 33: in Nagahama et al said active layer has a multi-quantum well structure alternately including one or more well layers and a plurality of barrier layers (cf. col. 36, l. 18-28), and inherently by virtue of the constitution of wells alternating with

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barriers the band gap of said active layer is the band gap of said one or more well layers.

On claim 34: it is understood in the art of semiconductor laser devices that the electric field distribution of laser light in the active layer is changed, i.e., has a time dependence, in accordance with a sine or cosine function because coherent light is activated within said active layer; and that the electric field of laser light in the cladding layer of a first conduction type is changed in accordance with an exponential function, as light is not activated but instead partly absorbed in said cladding layer. Therefore, the further limitation of claim 34 does not distinguish over the prior art.

On claim 36: said first conduction type in Nagahama et al is p-type (cf. discussion of claim 25 and col. 36, l. 47).

On claim 37: the nitride based semiconductor laser device by Nagahama et al further comprises a cladding layer 313 (cf. col. 35, l. 60 – col. 36, l. 8) of second conduction type (n-type) composed of a Group III nitride based semiconductor (cf. col. 35, l. 60 – col. 36, l. 8), wherein said light emitting layer is formed on said cladding layer of second conduction type (cf. Figure 9).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. ***Claim 35*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahama et al (6,172,382 B1) in view of Tanaka et al (4,961,197) (the latter previously made of record). Nagahama et al do not necessarily disclose the further limitation as defined by claim 35. However, the use of current blocking layers in the art of nitride based semiconductor laser devices for the specific purpose (*motivation*) to improve light emitting efficiency has long been known, as evidenced by Tanaka et al, who teach (cf. Figure 1) the nitride based semiconductor laser device to comprise a current blocking layer (cf. column 12, line 60 – column 13, line 28) formed on the upper cladding layer 5 (cf. column 12, line 60 – column 13, line 40) and having a striped opening (cf. column 12, line 60 – column 13, line 40). Combination of the teaching by Tanaka et al with the invention by Nagahama et al presents no difficulties as the layer by Tanaka et al can be standardly produced.

Allowable Subject Matter

5. **Claim 26** objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter: within the context of nitride based semiconductor laser device of claim 25 the further limitation sufficiently distinguishes over the prior art of the primary and secondary reference (Nagahama et al and Okumura as cited) considering the disclosure of Applicant, in particular the reasons for reducing the aluminum composition of said cladding layer to under 0.05 to reduce strain and consequent cracking.

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


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JPM
September 22, 2004